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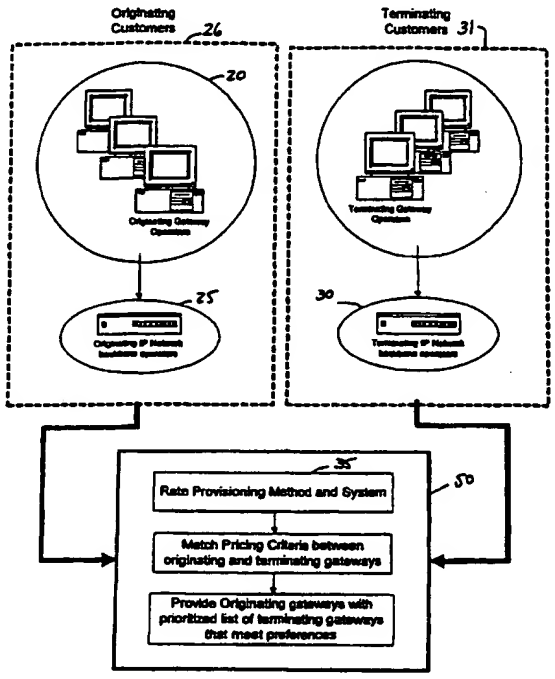

(57) Abstract: A rate provisioning method and system of the present invention utilizes a rate table with pre-assigned cells that may be used by both IP bandwidth providers (partners) and IP bandwidth customers (retail IP service providers). The rate table enables its users to enter information about their IP Telephony preferences, including pricing criteria. This information can be used by an IP call-routing engine to provide the originating gateway operators with a prioritized list of terminating gateways whose pricing criteria match those set by the originating gateway operators. The rate table

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of the present invention can be created with an ordinary spreadsheet computer program. After entering information into the pre-assigned cells of the rate table, a rate table can be saved in a file format that preserves the relative locations of the pre-assigned cells of the rate table. One such format is the CSV (comma separated values) format that can be used as a portable representation of the rate table.

RATE PROVISIONING METHOD AND SYSTEM FOR AN INTERNET TELEPHONY CLEARINGHOUSE SYSTEM

PRIORITY AND RELATED APPLICATIONS

The present application claims priority to provisional patent application entitled, "Automated Support of Internet Telephony Clearinghouse Services," filed on December 22, 1999 and assigned U.S. Application Serial Number 60/171,375. The present application is also related to the following pending applications: U.S. Application Serial Number, _____, entitled, "System and Method for the Secure Enrollment of Devices with a Clearinghouse for Internet Telephony and Multimedia Communications," filed on December 22, 2000; U.S. Application Serial Number, _____, entitled, "Call Detail Record Method and System for Internet Telephony Clearinghouse System," filed on December 22, 2000; and U.S. Application Serial Number, _____, entitled, "User Interface for Internet Telephony Clearinghouse System," filed on December 22, 2000.

TECHNICAL FIELD

The present invention generally relates to a rate input mechanism for voice over IP (Internet Protocol) communications. More particularly, the present invention relations to a rate provisioning method and system that assists in the tracking of voice over IP communications from a source gateway to a destination gateway.

BACKGROUND OF INVENTION

As an alternative to traditional switched circuit networks, telecommunications service providers have discovered that voice telephone calls may be routed over IP networks. Due to the fact that the Internet is not presently subject to the same international regulations as are traditional telephone networks, routing telephone calls over the Internet tends to be less expensive. Additionally, an IP routed voice telephone call requires much less bandwidth, and thus less cost, than a voice telephone call placed over a traditional telephone network. Further, IP technology advances are entered into the marketplace at a much faster rate than traditional telecom technology. Thus, in order to be competitive, telecommunications service

providers have begun to use IP routing as a way to offer customers access to the latest technological improvements.

Presently, however, there is no centralized system for routing voice telephone calls over an IP network. Each operator of a gateway is responsible for determining the routes for its own outgoing calls. Typically, gateway operators rely on traditional IP routing algorithms, which are designed to handle routing of computer generated data packets. Traditional IP routing algorithms attempt to strike a balance between the concerns of minimum delay and maximum reliability. Thus, using traditional IP routing algorithms, a voice telephone call will be routed to any destination gateway that happens to satisfy a set of predetermined criteria such as shortest path and acceptable data loss parameters.

The routing of voice telephone calls, however, involves a significant concern that is not shared by traditional IP routing algorithms. This additional concern is the monetary cost of routing a voice call to a particular destination gateway. As in traditional switched circuit networks, Internet telephony gateways impose fees for the service of terminating a voice call. Traditional IP routing algorithms are not able to detect and compare the varying price schedules that may be imposed by various Internet telephony gateways. Thus, source gateways are not able to discriminate between destination gateways based on monetary costs.

One way a gateway operator can establish the cost for IP telephony services is by negotiating directly with other gateway operators a fee for terminating each other's calls. These gateway operators could identify each other and establish a bilateral agreement or a multilateral agreement. This approach closely resembles that of the international circuit switch telephony network, where providers in each country have established bilateral and multilateral agreements with each other. A significant hurdle for this routing implementation, however, is the large number of business relationships that must be negotiated and maintained. For example, should 1,000 local operators decide to interconnect via bilateral agreements, 999,000 separate agreements would be necessary. Interconnection through a centralized system, however, would require only 1,000 separate business agreements, each with a separate operator.

Another disadvantage with a bilateral agreement model is that the gateway operators are not able to react quickly and intelligently to changing market forces because the bilateral agreements are generally long-term contracts. For example, when there is a sudden increase in demand for terminating calls to a particular area, the gateway operator in that area in unable to increase his terminating charges and take advantage of a demand. Additionally, a bilateral agreement model or the multilateral agreement model are too cumbersome for the gateway operators to set call pricing based on selected call number ranges (any given subset of all possible telephone numbers). This is especially true if the total number of telephone numbers comprising a called-number range is too small. For example, it may be too cumbersome for the gateway operators to negotiate a specific call pricing plan for a specific customer with less than 100 numbers within their called-number range.

Thus, there remains a need in the art for a method and system by which an originating gateway operator may set a price that it is willing to pay to a terminating gateway operator for the service of terminating a IP telephony call. There's also a need for a method and system by which a terminating gateway operator may set a price that it is willing to accept in exchange for terminating an Internet Telephony call. There is a further need for a method and system configured for use by an IP routing engine for selecting routing options for a call based on matching the pricing criteria set by the originating and terminating gateway operators.

There also remains a need in the art for a method and system by which a gateway operator may set or change call-pricing criteria on demand. There also remains a need in the art for a method and system by which a gateway operator may set or change call-pricing criteria associated with any subset of all possible telephone numbers. Additionally, there is a need in the art for a method and system which permits rapid implementation of changes to call-pricing criteria. Also, there is a need in the art for a method and system by which a gateway operator may set or change call-pricing criteria with minimal effort. There also is a need in the art for a method and system by which a gateway operator may set or change call pricing criteria by building upon previously-entered data. And lastly, there is a need in the art for a

method and system by which a gateway operator may set or change call pricing criteria that is simple for an ordinary computer user.

SUMMARY OF INVENTION

The present invention provides a method and system for defining pricing information to be used by a call-routing engine for the purpose of determining a preferred route for routing telephony calls from an originating gateway to a terminating gateway via an IP network. The Internet Telephony rate provisioning method and system of the present invention comprises a rate table with pre-assigned cells that may be used by both IP bandwidth providers (partners) and IP bandwidth customers (retail IP service providers). The rate table enables its users to enter information about their IP Telephony preferences, including pricing criteria. This information can be used by an IP call-routing engine to provide the originating gateway operators with a prioritized list of terminating gateways whose pricing criteria match those set by the originating gateway operators. The originating customers enter information relating to call prices they are willing to pay for calls to particular called numbers at particular times. Originating customers may often specify pricing criteria, which defines the circumstances in which call price is to be applied. Similarly, the terminating customers enter information about the call prices they charge for terminating calls to particular numbers at particular times. Terminating customers may also specify pricing criteria of their own. Call pricing information generally describes call prices as well as pricing criteria.

Call pricing information is but one example of preferences and preference criteria that may be used for the purpose of determining call-routing priorities. Other preferences include, but are not limited to, delay tolerance and expected reliability. Any preferences and preference criteria entered via the rate table may be stored in a database that is accessible by a call-routing engine. When a customer initiates a call, the originating gateway operator requests that the service point operator provide it with routing information necessary to terminate the call. Using call pricing information (i.e., call prices and pricing criteria) and other preferences and preference criteria derived from a rate table, the call-routing engine associated with the service

point operator determines the routing information corresponding to the most appropriate terminating gateways. A prioritized list of terminating gateways is then provided to the originating gateway. When provided with this prioritized routing information, the originating gateway may complete the call by choosing to terminate the call via any one of the appropriate terminating gateways.

Users can define the pricing criteria by creating various components which are then assembled to define what rates are preferred to what numbers at what times, by both the originating and terminating customers. Basically, the users enter the pricing criteria into pre-assigned cells of the rate table. The pre-assigned cells in the rate table are locations within the rate table that relate to specific properties of the pricing criteria. For a user's convenience and to decrease improper placement of pricing criteria within the rate table, the user can be provided with a rate table template that is generated by the centralized or clearinghouse IP telephony system.

A rate table can be created for each network device that is part of the centralized or clearinghouse IP telephony system. For example, a rate table can be created for each gateway that handles IP telephony traffic over the clearinghouse system. Each rate table can include a customer identification number, an Internet protocol address for the network device, the type of service supported (i.e. voice or fax), the type of rate plan (originating or terminating), a currency identifier, a rate plan name, a UTC (coordinated universal time)--based date on which the rate plan begins, and the call pricing information. However, the present invention is not limited to the aforementioned information. Also, a rate table may be configured such that certain cells are required cells while other cells within the rate table are optional.

The rate table of the present invention can be created with an ordinary spreadsheet computer program. After entering information into the pre-assigned cells of the rate table, a rate table can be saved in a file format that preserves the relative locations of the pre-assigned cells of the rate table. One such format is the CSV (comma separated values) format that can be used as a portable representation of the rate table. Such a portable representation of the rate table allows the rate table to be transferred to the centralized or clearinghouse system relatively easy. That is, after

completing entry of data into the rate table, it can be saved in the CSV file format and then it can be transferred to the centralized system for validation and implementation.

The centralized system can validate the transferred file containing the rate table information with relative ease, since the CSV file format preserves the pre-assignment of cells within the rate table. In other words, upon receipt of the transferred file, the centralized system can reconstruct the rate table because of the preservation of relative locations of the pre-assigned cells within the file format. The present invention is not limited to the CSV file format. Other file formats are not beyond the scope of the present invention. After validating and reconstructing the rate table contained within the transferred file, the centralized system can forward the rate information to one or more rate tracked network devices in the centralized system after a predefined period of time.

With the present invention, call-pricing information for network devices can be easily generated and modified with an application program that permits the manipulation of tables such as ordinary spreadsheet application programs. In this way, once call-pricing information is entered for a network device, further updates to the call-pricing information can be easily made when only a few entries are changed. That is, when the rate plans for certain network devices only require slight modifications, old rate tables containing previous rate information can be simply modified or changed. Such slightly modified rate tables can then be transferred to the centralized system for implementation of the new rate changes for the network devices that are part of the centralized Internet Telephony system.

That the invention improves over prior rate implementation devices for centralized or clearinghouse systems and accomplishes the advantages and goals described above will become apparent from the following detailed description of the exemplary embodiments in the appended drawings and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a functional block diagram illustrating one or more users that can be part of the centralized or clearinghouse system of the present invention.

Figure 2 is a schematic representation of an exemplary operating environment for the present invention.

Figure 3 provides an overview of the steps involved in an Internet telephone call in the exemplary operating environment.

Figure 4 is an exemplary display screen for an e-mail message according to the present invention.

Figure 5 is an exemplary display screen of a user interface for uploading a file to a rate plan database of the present invention.

Figure 6 is an exemplary rate table according to the present invention.

Figure 7 is a logic flow diagram illustrating an exemplary embodiment of a method for creating and implementing an Internet Telephony rate plan for network devices of a centralized system.

Figure 8 is a logic flow diagram illustrating an exemplary routine for transferring a file to the centralized system as set forth in Figure 7.

Figure 9 is a logic flow diagram illustrating an exemplary routine for receiving and validating data contained within a transferred file as set forth in Figure 7.

Figure 10 is a logic flow diagram illustrating another exemplary routine for transferring a file to the centralized system as set forth in Figure 7.

Figure 11 illustrates another exemplary routine for receiving and validating data contained within a file as set forth in Figure 7.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

The present invention is referred to herein as a rate provisioning method and system. The present invention provides a system and method for implementing preferences, such as pricing criteria, which are to be used by a routing engine for routing telephony calls from an originating gateway to a terminating gateway via an IP network. A telephone call occurring via an IP network is often referred to as a "voice over IP" transaction. When a "voice over IP" transaction specifically involves the Internet, the description "Internet Telephony" may also be used to describe the transaction. An exemplary embodiment of the present invention will be described herein with respect to Internet Telephony. However, the principles of the rate

provisioning method and system of the present invention apply to all IP routed transactions, including, but not limited to, "voice over IP" calls, "fax over IP" calls, and "video over IP" calls.

Exemplary Operating Environment

The following description of an exemplary operating environment and exemplary embodiments of the present invention will refer to the drawings, in which like numerals indicate like parts throughout the several figures. Referring to Figure 1, this figure shows an overview of a method of determining a preferred route for completing an Internet Telephony call using the rate provisioning method system **35** of the present invention. The originating gateway operators **20** represent the retail IP telephony service providers that set the price charged for a call placed by a telephone user. The originating IP network backbone operators **25** represent wholesale IP bandwidth providers who have agreements with the originating gateway operators **20** to provide the bandwidth in switching necessary to route the telephone call.

Similarly, the terminating gateway operators **15** represent the retail IP Telephony service providers that set the price for terminating a call placed by a telephone user. The terminating IP network backbone operators **30** represent wholesale IP bandwidth providers who have agreements with the terminating gateway operators **15** to provide the bandwidth and switching necessary to terminate a telephone call. Those skilled in the art will recognize that a gateway operator has the capacity to serve as a gateway for both originating and terminating telephone calls. In fact, originating gateway operators **20** and terminating gateway operators **15** typically differ only in the role played in a particular call. Similarly, backbone operators can handle both originating and terminating telephone calls. The originating backbone operators **25** and terminating backbone operators **30** typically differ only in the role played in a particular call. Henceforth, both an originating IP backbone operator **25** and an originating gateway operator **20** may collectively, or in the alternative, be referred to as originating customers **26**. Similarly, a terminating IP backbone operator **30** and a terminating gateway operator **15** will collectively, or in the alternative, be referred to as terminating customers **31**.

The rate provisioning method and system of a present invention allows an originating customer **26** to define preferences, such as rates that it is going to pay for calls placed to particular called numbers at particular times. Similarly, the rate provisioning method and system **35** allows a terminating customer **31** to define preferences, such as rates it will charge for terminating calls to particular called numbers at particular times. Information relating to rates that an originating customer **26** is going to pay may often be referred to as a "bid". Information relating to rates that a terminating customer **36** will charge for terminating calls may be referred to as an "ask". Henceforth, a bid placed and an ask placed collectively or in the alternative is referred to as call preferences.

Besides call preferences, the preferences defined by a customer may also relate, for example, to call delay and reliability. An exemplary embodiment of the rate provisioning method and system **35** may allow customers to define circumstances in which preferences are to be applied. For example, a customer may define preferences that relate to call preferences. A customer may also specify that the call preferences are to apply to calls made at certain times of the day, after a certain date, and/or to certain called telephone numbers. Such criteria defining when preferences are to be applied are referred to herein as preference criteria. In the case where the preference in question is a call preference, such preference criteria may be referred to as pricing criteria. Henceforth, the detailed description refers to pricing criteria in describing exemplary embodiments of the present invention. However, it should be understood that pricing criteria is just one example of preference criteria that may be used in the accordance with the present invention to match originating customers with terminating customers.

As illustrated in Figure 1, the exemplary rate provisioning method and system **35** may comprise a component of a system referred to herein as a centralized system or clearinghouse **50**. A clearinghouse **50** is configured to accept preferences and preference criteria, such as rate plans and schedules, from originating customers **26** and terminating customers **31**, via the rate provisioning method and system **35**. A clearinghouse **50** also implements functionality, which will be described below, for utilizing preference criteria in order to match an originating

customer's request to terminate a call with one or more terminating customers who are available to terminate the call and have pricing criteria and other preference criteria that match those defined by the originating customer **26**. The matching described above may be performed in real time because both the originating customers **26** and terminating customers **31** may change their respective call prices and price criteria via the rate provisioning method and system **35** whenever they so desire. As shown, a clearinghouse **50** may further be configured to send to originating customers **26** a prioritized list of available terminating customers **31**.

Clearinghouse Network Architecture

Referring to FIG. 2, this figure shows an network architecture that serves as an exemplary operating environment for the routing engine **110** of the present invention. As indicated, the Internet **102** serves as the heart of the exemplary network architecture. Relying on the Internet **102** are five different systems that might participate in an Internet Telephony transaction. These five systems include: a calling party **104**, a source gateway (also referred to as an originating gateway) **108**, a service point **112** including a routing engine **110**, a destination gateway (also referred to as a terminating gateway) **114** and a called party **118**. As FIG 2 shows, a service point **112** is coupled to a central database **120**, which is also coupled to a billing and settlement system **124**. While the service point **112** exists on the public Internet **102**, the central database **120** and the billing and settlement system **124** remain in secured facilities. Private communication paths connect the remote equipment with the central database **120**.

The calling party **104** represents the user wishing to place a telephone call. Often, the calling party **104** will rely on a standard telephone handset to place the call. In fact, in many cases the calling party **104** may not be able to distinguish Internet telephony service from standard telephone service. The calling party **104** connects to a source gateway **108** through a public telephone network **105**, such as a switched circuit network. In either case, the source gateway **108** serves as a bridge between ordinary telephones and the Internet **102** by converting telephone signals into data

packets (and vice versa) and transmitting the data packets over the Internet **102**. A source gateway is operated by a source gateway operator **109**.

Similarly, the called party **118** is the user that receives a telephone call. A called party **118** connects to destination gateways **114** through a public telephone network **106**, such as a switched circuit network. A destination gateway **114** is connected to the Internet **102** at a location that is remote from the source gateway **108**. The destination gateway **114** is operated by a destination gateway operator **115** and performs the same functions as the source gateway **108**, i.e., bridging phone calls between the Internet **102** and a public telephone network **106**, or an equivalent thereof. Destination gateways **114** differ from source gateways **108** only in the role played in a particular call. In particular, source gateways **108** act on behalf of the calling party **104**, while destination gateways **114** act on behalf of the called party **118**. It is important to note that the same operator need not manage both the source gateway **108** and the destination gateway **114**. In fact, the exemplary routing engine **110**, is tailored for environments in which different owners operate the two types of gateways.

The service point operator **125** may be a third party that is independent of the operators of the source gateway **108** or destination gateways **114**. As indicated in FIG. 2, the service point operator **125** may maintain a private communications line with the service point **112**, the billing and settlement system **124** and a related web-site **122**. In the exemplary operating environment, all components maintained by the service point operator **125**, i.e., the service point **112**, the database **120**, the billing and settlement system **124** and the web-site **122**, are conveniently distributed between various geographic locations. Still, those skilled in art will appreciate that all components maintained by the service point operator **125** may be incorporated in a single system (service point **112**) or any number of distributed systems.

A service point **112** communicates with gateways over the Internet **102** and generally provides routing information to the source gateway **108**. Given a destination phone number and other requirements (described in detail below), the service point **112**, through the routing engine **110**, identifies at least one appropriate destination gateway **114** to handle the telephone call.

The overall network architecture that serves as an operating environment for the exemplary routing engine **110** may be thought of as comprising three different networks, each carrying the telephone conversation. The first network is the calling party's telephone network **105** that connects the calling party to the source gateway **108**. The second network is the Internet **102**, which connects the source gateway **108** and the destination gateways **114** to each other. The third network is the called party's telephone network **106**, which completes the connection from the destination gateway **114** to the called party **118**. Although FIG. 2 (as well as this description in general) refers to the telephone connections as taking place through public telephone networks **105** and **106**, Internet telephony service does not require such a connection. Some applications may use private networks, such as those provided by a private branch exchange; others may simply connect telephone handsets directly to the corresponding gateway.

Additionally, a fourth network may be added to the general network architecture. The fourth network is a banking and funds transfer network **126**. A billing and settlement system **124** may be coupled to the service point **112** in order to receive information relating to the financial aspects of the Internet telephony transactions. The billing and settlement system **124** may use a banking and funds transfer network **126** to execute the financial transactions coordinated by the service point **112**.

Internet Telephony Example

FIG. 3 provides an overview of an Internet telephony call in the exemplary operating environment. At step **201**, an Internet telephony call is initiated when the calling party **104** dials a telephone number, which is transmitted to the source gateway **108** for processing. The goal of the source gateway **108** is to locate a destination gateway **114**a-c that is able to terminate the phone call. The source gateway **108** relies on the service point **112** for routing assistance.

At step **202**, the source gateway **108** makes an authorization request to a service point **112**. The authorization request indicates, among other things, the telephone number of the called party **118**. At the service point **112**, the routing engine

110 uses information in the authorization request, as well as preferences established for the source gateway's 108 cost and quality requirements, to determine which of the destination gateways 114a-c are eligible to complete the call.

At step 203, the service point 112 then sends an authorization response message to the source gateway 108, which includes information relating to the identity of eligible destination gateways 114. In addition, the authorization response message contains an authorization ticket for access to each eligible destination gateway 114. The authorization response ticket allows a destination gateway 114 to accept the call knowing that it has been authorized by the service point 112, and that the service point operator 125 will compensate the destination gateway operator 115 for completing the call.

Upon receipt of the authorization response message, the source gateway 108 selects a destination gateway 114 from among the list provided by the service point 112. At step 204, the originating gateway 108 then sends a setup message to the selected destination gateway 114, as specified in International Telecommunications Union (ITU) H.323 and associated standards. Those skilled in the art will recognize that the Q.931 standard may be used to define the setup message. To complete the authorization, the setup message must include the authorization ticket for the destination gateway 114. Those skilled in the art will also recognize that the user-to-user information element of the Q.931 setup message may be used to convey the authorization ticket.

Communication between the service point 112, the source gateway 108 and the destination gateways 114 does not require the use of standard protocols for any aspect of the Internet telephony calls themselves, including call setup. If the source gateway 108 and destination gateways 114 use a signaling protocol other than Q.931 (which is specified by H.323 and H.225.0), then that protocol need only be capable of including the authorization ticket in the initial setup message. The exemplary authorization ticket is approximately 2000 octets in length. Destination gateways 114a-c may accept or reject Internet telephony calls based on the presence and contents of this authorization ticket.

After the Internet telephony call is completed, both the source gateway **108** and the destination gateway **114** transmit a call detail report to the service point **112**, as represented in steps **205** and **206**. Call detail reports identify the call and record its duration. Call detail reports are stored in the database **120** and are accessed by the billing and settlement system **124** in order to reconcile financial obligations between the service point operator **125**, source gateway operators 109 and destination gateway operators **115**.

It should be noted that source gateway **108** and destination gateways **114** are free to establish connections without consulting a service point **112**. For example, a group of gateways may all be owned by a common entity and may wish to exchange calls among themselves independent of a service point **112**. In such an environment, the gateways are free to rely on a service point **112** only when no gateway in the group can serve a given phone number economically. Thus, the exemplary operating environment provides gateways with extremely flexible routing choices.

Also, those skilled in the art will appreciate that the exemplary operating environment may include multiple service points **112**. Service points may be distinguished by the specific services they provide, as well as by their geographic location on the Internet **102**. Geographic diversity optimizes performance by allowing a device to communicate with the closest service point **112**. Proximity to a service point **112** minimizes delay in the communication exchange. Geographic diversity also increases the reliability of the operating environment. If one service point **112** becomes unavailable, devices using that service point **112** can automatically switch to a different service point (not shown) located elsewhere.

Before a gateway is provided with access to a service point **112** the responsible gateway operator must enroll as a customer of the service point operator **125**. The customer enrollment process may take place through the web-site **122**, via the Internet **102**, using any well-known web browser. Gateway operators 109 & 115 typically perform the enrollment from a desktop computer. Since the enrollment process typically requires disclosure of sensitive financial information (such as bank accounts or credit card numbers), the web connection between the gateway operators 109 & 115 and the web-site **122** is secured by the secure sockets layer (SSL) protocol.

The web-site **122** uses SSL to authenticate itself to gateway operators 109 & 115 with digital certificates obtained from a trusted certificate authority. SSL also encrypts the information transferred between the gateway operators 109 & 115 and the web-site **122**.

When the service point operator **125** accepts a gateway operator as a customer, it provides the customer with a customer number and password. The customer number is Hamming coded to protect against corruption. Once assigned, customers are allowed to change their password. The service point operator **125** may enforce certain restrictions on passwords to maximize security. Such restrictions may include, for example, a prohibition against words appearing in dictionaries, a requirement to use both upper and lower case characters and a requirement that customers change their password periodically.

After enrollment is complete, gateway operators **109** and **115** are given authorization to access and modify their accounts, via the Internet **102**, through the web-site **122** which may also host the rate provisioning method and system **35**. Enrolled customers may also be provided with access to timely and informative reports on their usage of a service point **112**. Such reports may include up-to-the-minute billing information, potential fraud alerts, sophisticated usage statistics and detailed traffic profiles. Enrolled users may access these reports directly through the web-site **122**, using a web browser, or they can download the information for importing into their own database or spreadsheet. Users may also elect to be notified via electronic mail, fax, or other means when certain events occur. Events eligible for this service include suspicious or fraudulent activity, minimum or maximum traffic levels at particular devices, and apparent failure of a device.

An enrolled customer may activate individual devices to use the services provided by a service point **112**. In the present discussion, the exemplary devices are Internet-telephony gateways **108** and **114**. However, those skilled in the art will appreciate that the exemplary operating environment may be configured to supports a wide variety of devices. As with operator enrollment, device activation takes place across the Internet **102** using well-known web browsers. Typically, device activation

will take place at the device itself, while operator enrollment is performed from an operator's personal computer or workstation.

The web-site **122** may be configured to support several different approaches for activating devices, depending on the particular type of device. The web-site **122** may be configured to support Windows, UNIX, and embedded operating environments. Those skilled in the art will recognize that other operating systems may also be supported.

With respect to the Windows operating environment, exemplary web-site **122** may be designed to support the operating environments of Windows 95, Windows 98 and Windows NT version 4.0 and later (collectively referred to as "Win32 platforms"). For these operating environments, reliance may be placed heavily on Microsoft's Internet Explorer (version 3.02 and later) to generate key pairs and to request and install certificates. The Certificate Server component of Microsoft's Internet Information Server version 4.0 may be used to grant certificate requests.

As indicated in Figure 2, a clearinghouse **50** may comprise the components of a service point **112** (including a routing engine **110**), a database **120**, a website **122** hosting the rate provisioning method and system **35** and a billing and settlement system **124**. A service point operator **125** may be responsible for maintaining the clearinghouse **50**. A service point operator **125** may be a third party that is independent of the originating gateway operator **20** or the terminating gateway operators **15**. As illustrated in Figure 2, the service point operator **125** may maintain a private communications line with the service point **112**, a billing and settlement system **124** and the website **122**. In the exemplary operating environment, all components maintained by the service point operator **125** can be conveniently distributed between various geographic locations. Still, the skill of the art will appreciate that all components maintained by the service point operator **125** may be incorporated in a single system or any number of distributed systems.

As mentioned above, a clearinghouse **50** may be configured to provide an originating gateway **108** with routing information relating to those terminating customers **31** who match the call prices and pricing criteria (and other preferences and preference criteria) set by the originating customers **26**. A service point **112**

communicates with gateways over the IP network **102** and generally provides routing information to an originating gateway **108**. The service point **112**, through the routing engine **110**, identifies at least one appropriate terminating gateway **114** to handle a call. The service point **112** is coupled to the clearinghouse settlement platform that hosts the web-based user interface **122**, the rate provisioning system **35**, and the billing system. The function of the rate provisioning method and system **35** is to provide a mechanism by which originating customers **26** and terminating customers **31** may enter their respective call prices and pricing criteria to be used by the routing engine **110** in order to provide routing information to the originating gateways based on the best matches for their preferences and preference criteria.

Also mentioned above, call prices are but one example for preferences that may be defined by an originating gateway operator **20**. Other preferences may relate, for example, to delay times and expected reliability. The routing engine **110** may be configured to use the preferences set by the originating gateway operator **20** as filters for eliminating potential terminating gateways and determining the most appropriate terminating gateway to terminate a call. An originating gateway operator **20** may specify none or any combination of preferences as its filters. Also, an originating gateway operator **20** or a service point operator **125** may specify the maximum number of call routes that are to be returned by the routing engine **110** in response to a call authorization request.

In an exemplary embodiment, a first preference referred to herein may be defined as "the maximum delay that an originating gateway operator **20** is willing to tolerate." The maximum delay is preferably the overall network delay, which is measured by the time taken for a signal to travel between the calling party **104** and the called party **118**. The lower the network delay from when the calling party **104** speaks to when the called party **118** hears the words, the higher the quality of the conversation. Those skilled in the art will appreciate that there are many other factors that determine delay or latency in a voice telephone call. Other examples of delay include: delay due to interlocking of digital conversation, buffering delays inside gateways, delays on public switch telephone networks (PSTN), etc. It is contemplated that such other sources of delay may be factored into the "maximum

delay preference." However, it is expected that network delay will be the most significant contributor to the overall quality of an Internet Telephony call. Thus, in the exemplary embodiment, other sources of delay can be ignored.

Another preference can be the "maximum autonomous system (AS) hop count that the originating gateway operator will tolerate." The IP network **102** may comprise a collection of "autonomous" IP networks. Thus, a voice signal traveling from an originating gateway **108** to a terminating gateway **114** may traverse one or more autonomous systems. The fewer autonomous systems that a signal must traverse, the lower the network delay should be. While it is not necessarily true that a lower AS hop count will lead to lower delay, AS hop count does provide a good estimation of network delay. Furthermore, a lower AS hop count tends to suggest that there will be less signal loss (packet loss) when the voice signal reaches its destination.

A determination of AS hop count is instantaneous and may be derived from information relating the dynamic topology of the IP network **102**, which is dictated by congestion, etc., that is continuously gathered and stored in the database **120**. To the contrary, network delay may only be determined by an actual measurement, as described above, which involves significantly more time than an AS hop count calculation. Therefore, an originating gateway operator **20** may elect to use the AS hop count as hop count preference, rather than the "maximum delay" preference.

An additional preference may be defined as "autonomous system (AS) matching," which dictates that, whenever possible, a route should be chosen such that both the originating gateway and the terminating gateway **114** are the same AS. A determination of AS matching is similar to a termination of AS hop count. A determination of AS matching dictates that given the choice of an AS hop count of 0 and any other AS hop count, the route having the AS hop count of 0 will be chosen. Similarly, "domain matching" and "platform matching" preferences may be defined, such that no terminating gateway **114** that operates in a specified domain or on a specified platform will be selected to terminate a call.

Another preference can be "a maximum rate the originating gateway operator **20** is willing to pay for a call to a specific telephone number." All

terminating gateways **114** charging rates (the ask) that are greater than the bid are eliminated from the search for the optimal call route. A bid may be specified as a function of time of day, day of the week and/or destination. All preferences (bids and asks) may be expressed in any type of currency and any fraction thereof.

An originating gateway operator **20** may set as many or as few preferences as it would like. It is contemplated that preferences other than the exemplary preferences described herein may also be implemented. For example, the originating gateway operator may also set preferences defining that all terminating gateways **114** that are not intraoperable with the originating gateway **108**, or do not offer the requested type of service, i.e., voice or fax, are to be eliminated from consideration. Other preferences may include, but are not limited to the following: "historical availability," which eliminates from consideration all terminating gateways **114** that have historical availability less than the required availability specified by the originating gateway operator **20**; "preferred operator," which eliminates from consideration all terminating gateways **114** that are not operated by a preferred operator specified by the originating gateway operator **20**; "packet loss," which eliminates from consideration all terminating gateways **114** whose historical packet loss is greater than the minimum specified by the originating gateway operator **20**; "latency," which eliminates from consideration all terminating gateways **114** whose historical packet loss is greater than the maximum latency specified by the originating gateway operator **20**; "quality of service (QoS) score" which eliminates from consideration all terminating gateways **114** whose QoS is less than the minimum specified by the originating gateway operator **20**; "RSVP preference," which eliminates from consideration all terminating gateways **114** that cannot support, or are on networks that do not support, bandwidth reservation; and "best worst case," which eliminates from consideration all terminating gateways **114** whose best worst case scenario for packet loss and latency exceeds the minimum best worst case scenario specified by the originating gateway operator **20**. The best worst case is estimated by summing packet loss or latency between the originating gateway **20** and the reference point maintained by the service point operator **125** plus the latency and packet loss between the terminating gateway and a service point operator **125**. For example, the

worst case for packet latency between the originating gateway **108** and the terminating gateway **114** and assumed to be equal to the packet latency between the originating gateway **108** and the service point operator **125** plus the terminating gateway and the service point operator **125**.

Rate Provisioning Method and System

Referring now to Figure 4, this figure illustrates an exemplary display screen **400** for generating an e-mail message **410** that can be transmitted from an originating customer **26** or a terminating customer **31** The e-mail message **410** can be generated by any application program such as Microsoft Outlook or other types of application programs. The e-mail message **410** is but one method of transferring a rate plan table to the centralized or clearinghouse system **50**. In this exemplary embodiment, the e-mail message **410** has a "To" field in which the e-mail message **410** is addressed. The e-mail message **410** further includes a "subject" field **430** that has a predefined format. The predefined format includes the word "provision" followed by the variables A, B, C, and D. The variable "A" can represent the customer or subscriber identification number while the variable "B" can represent a gateway identification number. The variable "C" can represent the service type (such as voice or fax). The variable "D" can represent the traffic type (such as originating or terminating). The file attachment **440** should contain the rate trend table that has been saved as a CSV (comma separated values) file format that saves only the text and values as they are displayed in cells of the rate plan table. With this file format, the relative locations of pre-assigned cells within the rate plan table are preserved. For example, with the CSV file format, all rows and all characters in each cell of a table are saved. Columns with data are separated by columns, and each row of data ends in a carriage return. If a cell contains a comma, the cell contents are enclosed in double quotation marks. The present invention is not limited to the CSV file format. Any file format can be utilized as long as the file format preserves the relative locations of the pre-assigned cells within the rate table.

Figure 5 illustrates another exemplary display screen **500** that includes a user interface **510**, which can be hosted by website **122** (See Fig. 2). The user interface

510 may have multiple frames where one frame displays a logo 520 of a user. Other frames can display a navigational tool 530 for navigating through the data supported by website 122. Another frame can include other tools or links such as the "upload new rate plan" link 540. Upon activating link 540, the user can designate a location of the file containing the rate plan table that provides for the new or updated rate plan information. Similar to the embodiment discussed with respect to Figure 4, the file containing the rate plan table for the embodiment illustrated in Figure 5 should also be saved in a file format that preserves the relative locations of the preassigned cells within the rate table. Preferably, in the exemplary embodiment, such a file format is the CSV file format discussed above.

Figure 6 illustrates an exemplary rate plan table 600 according to the present invention. This rate plan table 600 can be created by an application program supporting tables such as an ordinary spreadsheet program like Microsoft Excel. Each cell 610 of the table is defined according to a row number and a column number. For example, cell 610A is defined by column B, row 1. Cell 610A can contain a customer identification number. Cell 610B can denote the gateway identification number from a device information page of the user interface hosted by website 122. Further details of the remaining cells 610C through 610Q will be discussed and explained in further detail in Table 3 listed below. The present invention is not limited to the cell assignment illustrated in Figure 6. Different cell assignments, as well as increased or decreased number of cells with respect to those shown in Table 600 can be provided. In other words, the present invention is not limited to the number and type of cell assignments illustrated in Figure 6.

Referring now to cell 610G, the cells that fall within the column defined by cell 610G refer to predefined geographical regions that can be used in setting up a single rate for a grouping of countries. For example, in the rate plan table, you can create one rate row for a region denoted as "AS" represents the geographic region of Africa. In the geographic region of Africa, a user may establish rate rows within the rate table for specific countries within the predefined country region, such as Egypt and Libya. In this example, all countries in the Africa region would inherit the rate for the "AS" region, except for the countries of Egypt and Libya (since these

countries would have their own separate rate rows within the rate plan table). Such a system prevents the user having to create multiple rows for multiple countries in the same zone with the same rate.

As another example of the zone rate assignment system, reference is made to Table I. Table I demonstrates how separate rate rows can be created for individual countries within a calling zone or individual cities within a country. For example, according to Table I, all calls to 140485l will have a rate of 0.0555 units. (See the third row of Table I). All calls to 1404 (and not to 404851) will have a rate of 0.055 units. (See row 2 of Table I). All calls to 1 (and not 404) will have a rate of 0.05 units. (See the first row of Table I). All calls to country code 33 (France) will have a rate of 0.08 units. (See the fourth row of Table I). All calls to countries in the Europe country zone (except France) will have a rate of 0.09 units. (See the fourth row of Table I). All calls to all other destinations will have a rate of 0.15 units. (See the sixth row of Table I).

Table I - Zone Rate Assignment System - Illustration 1

Zone	CC	City Code/NPA-NXX	Rate
	1		.05
	1	404	.055
	1	404851	.0555
	33		.08
EU			.09
OT			.15

Another example of assigning rates to calling zones and specific locations within a calling zone is illustrated in Table II. According to Table II, the first row, all calls to countries in Central/South America will have a rate of 0.08 units. Meanwhile, according to the second row of this table, all countries in Asia except to city code 1 in Turkey (country code 90 -- see the fourth row of Table II) and to China (country code 86 -- see the third row of Table II) will have a rate of 0.09 units. All calls to China (which has a country code of 86) will have the rate of 0.10 units. All calls to city code 1 in Turkey (which has a country code of 90) will have a rate of 0.11 units, as set

forth in the fourth row of Table II. All calls to all other destinations will have a rate of 0.12 units, as set forth in the fifth row of Table 2.

Table II - Zone Rate Assignment System - Illustration 2

Zone	CC	City Code/NPA-NXX	Rate
SA			$.08
AS			$.09
	86		$.10
	90	1	$.11
OT			$.12

A calling zone may comprise one of the following regions: "AF", which denotes Africa; "EU", which denotes Europe; "AP", which denotes Australia/South Pacific; "AS", which denotes Asia; "CA", which denotes Central and South America; and "OT", which denotes the rest of the word. The country codes for the countries contained within the aforementioned zones are listed in Table VI. The country codes listed in Table VI may not include the latest and most accurate E.164 country codes. According to the International Telecommunications Standard ITU E.164, an international telephone number consists of a one to three-digit country code followed by no more than twelve additional digits. The first digit of the country code may be a digit from one to nine, and this is called a "zone." Therefore, all possible telephone numbers may be divided into called number ranges roughly by zone, or finally by country code, and with increasing specificity as the length of the number prefix is extended. By way of illustration, a called number prefix ("+1"), dialed from anywhere in the world, defines a called number range that includes telephone numbers in North and Central America (the plus sign is an international convention that represents whatever the user must do in preface to making an international call. In the United States, that usually means dialing the digits "011," but the exact procedure varies from country to country). Similarly, the called number prefix of "+1404" defines a called number range that includes numbers in Atlanta, Georgia. The exemplary rate plan table of the present invention is configured to allow a

number prefix having a maximum of fifteen digits due to the fact that an international telephone number includes up to fifteen digits by convention. However, should there be a reason to extend a called number prefix past the current number of fifteen digits, the rate plan table of the present invention may be configured to do so.

Any countries not included in the zones set forth in Table VI are not considered part of a predefined region, and the number string will have to be defined in the country code and city code/NPA-NXX columns of the rate plan table. However, the present invention is not limited to the E.164 country code standard. Any grouping of countries or cities or both can be adopted by the present invention.

Referring now to Table III, as mentioned above, this table describes the cell assignments for the rate plan Table **600**, as illustrated in Figure 6. As noted above, Table III and Table **600** of Figure 6 are illustrative exemplary embodiments of the present invention. In other words, the present invention is not limited to these cell assignments as can be appreciated to those of ordinary skill in the art.

Table III - Cell Assignments

Cell(s)	Description/Action
1A	Enter the label "Customer ID".
1B	Enter the subscriber ID from the General Information page of the User Interface.
2A	Enter the label "Device Name".
2B	Enter the gateway ID from the Device Information page of the User Interface.
3A	Enter the label "Service Type".
3B	Enter "V" for voice or "F" for fax.
4A	Enter the label "Assignment Type".
4B	Enter "O" for originating rate plan assignment or "T" for terminating rate plan assignment.
5A	Enter the label "Currency".
5B	Enter "1" (for $US).
6A	Enter the label "RP Name".
6B	Enter an 8-character name for this rate plan.
8A	Enter the label "BEGIN"
9A:9C	This is the Called Number String composed of values in columns A through C. Zone (column A value) may be: • <blank> • AF = Africa Region (see list of countries in Table VI)

	• EU = Europe Region (see list of countries in Table VI) • AP = Australia/South Pacific Region (see list of countries in Table VI) • AS = Asia Region (see list of countries in Table VI) • SA = Central and South America Region (see list of countries in Table VI) • OT = Rest of World (all files must include at least one row with this value which is a default region) If one of the above values appears in Column A, there cannot be values in Columns B and C and vice versa. You may define rates by: • Region (input Region code in column A; no values in columns B and C) • Country Code (input country code value in column B; no values in columns A and C) • Combination of Country Code and City Code (input country code value in column B and city code or NPA/NXX in column C; no value in column A) Columns B and C represent the Country Code and City Code respectively. The sum of digits in columns B and C may not exceed 7.
9D	Enter rate in $US per minute. Value may be up to 4 decimal places.
9E	Enter "60".
9F	Enter "second".
9G	Enter the date when this rate becomes effective. Usually this will be the current date. But it is also possible to schedule future changes. That is, you may create several rows with the same number string but with different begin dates and different rates as long as one of the begin dates is less than or equal to the date/time the file is submitted to the centralized system **50**.
9H	Leave blank. (future use)
9I	Leave blank. (future use)
9J	If rates are for terminating gateway, enter "Y" if termination is allowed to this gateway for this row's Called Number String. Enter "N" if termination is not allowed. If rates are for originating gateway, enter "Y" if origination is allowed from this gateway for this row's Called Number String. Enter "N" if origination is not allowed.

Referring now to Table IV, this table explains which particular cells within the rate plan table are required to have values. The table also provides an additional brief description of each cell's content. It is noted that some descriptions refer to a "phase". This "phase" is identifying how the present invention can be implemented in stages. During an initial phase, such as Phase I, the functionality or capability of the clearinghouse system **50** may be somewhat limited. After subsequent phases, such as Phase II, functionality of the clearinghouse system 50 will be enhanced to include

additional capabilities or options. Some descriptions of Table IV also refer to "UTC-based dates" UTC denotes coordinated universal time, which is the standard time common to every place in the world. In other words, UTC normally reflects the mean solar time along the prime meridian (0 degrees longitude) that runs through the Greenwich Observatory located outside of London, UK, where the current system originated. Coordinated universal time is expressed using a 24-hour clock and uses the Gregorian calendar. It is used in airplane and ship navigation, where it is also sometimes known as "Zulu time", Zulu being the military word for the letter "Z" and for the longitude 0. The full definition of coordinated universal time can be found in ITU-T Recommendation X.680 (7/94).

Table IV - Required and Optional Cells for Rate Plan Table 600 of Fig. 6

Cell or Row or Column	Required	Description
B1	Y	User enters Customer ID
B2	Y	User enters IP Address (IP_DNI)
B3	Y	In Phase I, only "V" (voice) or "F" (fax) or supported.
B4	Y	User enters "T" for terminating rate plan or "O" for originating rate plan
B5	Y	Currency ID
B6	Y	User enters rate plan name (up to 8 alpha-numeric).
Column A (A9)	N if Column B has a value, Y if Column B does not have a value	Zone may be: AF = Africa EU = Europe AP = Australia/South Pacific AS = Asia SA = Central and South America OT = Rest of World (all files must include at least one row with this value) If one of the above values appears in Column A, there cannot be values in Columns B and C and vice versa.
Column B (B9)	N if Column A has a value, Y if Column A	Note that "1" is the country code for all North American locations. All valid country codes (outside North America) are listed in Section 6 of this document.

	does not have a value	
Column C (C9)	N	This is the city code or NPA-NXX. This value may be up to 6 digits.
Column D (D9)	See Section 5, item 5	User enters rate per minute (up to 4 decimal places).
Column E (E9)	See Section 5, item 5	In phase I, only "60" is supported.
Column F (F9)	See Section 5, item 5	In phase I, only "second" is supported.
Column G (G9)	Y	User enters the UTC-based date on which this rate begins; format mm/dd/yy
Column H (H9)	N	(Applicable to Origination Rate Plans only; see cell B4) In Phase I, this field will be left blank. In Phase II, user enters Maximum Delay in milliseconds. This is an optional field. User may leave blank or enter any of the following values to be determined.
Column I (I9)	See Section 5, item 5	(Applicable to Origination Rate Plans only; see cell B4) In Phase I, "LC" is supported. In Phase II, user may enter one of the following Routing Priorities: "LC" (Least Cost) "LD" (Least Delay) "SA" (Same Autonomous System)
Column J (J9)	Y	User enters "Y" to allow origination from or termination to this device; otherwise, "N"

Referring now to Table V, this table provides an explanation of various cells contained within the rows of Table 600 of Figure 6. The information contained within Table V assumes that the rate plan data contain within Table 600 arrived at the service point **125** on July 16, 1999 at 3:00 a.m. UTC.

Table V - Explanation of Rate Plan Data in Table 600 of Fig. 6

Row	Explanation
9	• This device will be a candidate to terminate calls to "1" (but not those matching 1770452, 1770 or 1404) from 7/16/99 03:00:00 UTC through 7/31/99 23:59:59 UTC @ .04/min.

10	• This device will be a candidate to terminate calls to "1" (but not those matching 1770452, 1770 or 1404) from 8/1/99 00:00:00 or later @ .045/min.
11	• This device will be a candidate to terminate calls to "1404" from 7/16/99 03:00:00 UTC or later @ .042/min.
12	• This device will be a candidate to terminate calls to "1770" (excluding 1770452) from 7/16/99 03:00:00 UTC or later @ .043/min.
13	• This device will be a candidate to terminate calls to "177045" from 7/16/99 03:00:00 UTC or later @ .055/min.
14	• This device will be a candidate to terminate all calls to Europe (CC's = 3 or 4) from 7/16/99 03:00:00 UTC or later @ .077/min.
15	• This device will be a candidate to terminate all calls to Africa (CC's = 2) except Morocco (CC 212) from 7/16/99 03:00:00 UTC or later @ .0912/min.
16	• This device will be a candidate to terminate all calls to Morocco (CC = 212) from 7/16/99 03:00:00 UTC or later @ .345/min.
17	• This device will NOT be a candidate to terminate calls to "5411" from 7/16/99 03:00:00 UTC through 8/14/99 23:59:59 UTC since "Allow" = "N".
18	• This device will be a candidate to terminate calls to "5411" from 8/15/99 00:00:00 UTC or later @ .065/min.
19	• In the context of this rate plan, "OT" includes all calls to "5" (except "5411"), "6", "7", "8" and "9". This device will be a candidate to terminate calls matching those number prefixes from 7/16/99 03:00:00 UTC or later @ .070/min.

Referring now to Table VI, as mentioned above, this table lists the individual countries that form each of the five calling zones that include "AF" for Africa, "EU" for Europe, "AP" for Australia/South Pacific, "AS" for Asia, and "SA" for Central and South America. Also listed adjacent to each country contained within a zone is each country's country code according to the ITU E.164 standard. It is noted that these lists may not include the latest and most accurate E.164 country codes. The most current listing of the country codes can usually be found at the following website: www.itu.ch. According to the present invention, any countries not included in Table VI are not considered to be part of a predefined region, and therefore, the number string for a particular country not considered part of a predefined region may have to be defined in the country code and city code/NTA-NXX columns of the rate plan table. It is noted that the columns of Table VI are in a "newspaper" format. Data

in one column on a page continues to an adjacent column (in a left to right, top to bottom fashion) when the data of Table VI is displayed on more than one page.

Table VI - Predefined Regions and Countries in each Region

Africa (AF)
20 - Egypt
212 - Morocco
213 - Algeria
216 - Tunisia
218 - Libya
220 - Gambia
221 - Senegal
222 - Mauritania
223 - Mali Republic
224 - Guinea (PRP)
225 - Ivory Coast
226 - Burkina Faso
227 - Niger
228 - Togo
229 - Benin
230 - Mauritius
231 - Liberia
232 - Sierra Leone
233 - Ghana
234 - Nigeria
235 - Chad
236 - Central African Republic
237 - Cameroon
238 - Cape Verde Islands
239 - Sáo Tomé and Principe
240 - Equatorial Guinea
241 - Gabon
242 - Congo
243 - Zaire
244 - Angola
245 - Guinea-Bissau
246 - Diego Garcia
247 - Ascension Island
248 - Seychelles Islands
249 - Sudan
250 - Rwanda
251 - Ethiopia
252 - Somalia
253 - Djibouti
254 - Kenya
255 - Tanzania
256 - Uganda
257 - Burundi
258 - Mozambique
260 - Zambia
261 - Madagascar
262 - Réunion Island
263 - Zimbabwe
264 - Namibia
265 - Malawi
266 - Lesotho
267 - Botswana
268 - Swaziland
269 - Comoros/Mayotte Island
27 - South Africa
290 - St. Helena
291 - Eritrea
298 - Faeroe Islands
299 - Greenland

Europe (EU)
30 - Greece
31 - Netherlands
32 - Belgium
33 - France
34 - Spain
350 - Gibraltar
351 - Portugal
352 - Luxembourg
353 - Ireland
354 - Iceland
355 - Albania
356 - Malta
357 - Cyprus
358 - Finland
359 - Bulgaria
36 - Hungary
370 - Lithuania
371 - Latvia
372 - Estonia
373 - Moldova
374 - Armenia
375 - Belarus
376 - Andorra/Vatican City
377 - Monaco
378 - San Marino
380 - Ukraine
381 - Yugoslavia/Serbia
385 - Croatia
386 - Slovenia
387 - Bosnia & Herzogovina
389 - Macedonia
39 - Italy
40 - Romania
41 - Switzerland/Liechtenstein
420 - Czech Republic
421 - Slovak Republic
43 - Austria
44 - United Kingdom
45 - Denmark
46 - Sweden
47 - Norway
48 - Poland
49 - Germany

Central/South America (SA)
500 - Falkland Islands
501 - Belize
502 - Guatemala
503 - El Salvador
504 - Honduras
505 - Nicaragua
506 - Costa Rica
507 - Panama
508 - St. Pierre & Miquelon
509 - Haiti
51 - Peru
52 - Mexico
53 - Cuba
54 - Argentina
55 - Brazil
56 - Chile/Easter_Island
57 - Colombia
58 - Venezuela

590 - Guadeloupe
591 - Bolivia
592 - Guyana
593 - Ecuador
594 - French Guiana
595 - Paraguay
596 - Martinique/French Antilles
597 - Suriname
598 - Uruguay
599 - Netherlands Antilles

Australia/South Pacific (AP)

60 - Malaysia
61 - Australia/Cocos-Keeling Islands
62 - Indonesia
63 - Philippines
64 - New Zealand/Chatham Island
65 - Singapore
66 - Thailand
670 - Mariana Islands
671 - Guam
672 - Christmas & Norfolk Islands/Antarctica
673 - Brunei
674 - Nauru
675 - Papua New Guinea
676 - Tonga Islands
677 - Solomon Islands
678 - Vanuatu
679 - Fiji Islands
680 - Palau
681 - Wallis and Futuna Islands
682 - Cook Islands
683 - Niue
684 - American Samoa
685 - Western Samoa
686 - Kiribati
687 - New Caledonia
688 - Tuvalu
689 - French Polynesia
690 - Tokelau
691 - Micronesia
692 - Marshall Islands

Asia (AS)

7 - Russia/CIS
81 - Japan
82 - South Korea
84 - Vietnam
850 - North Korea
852 - Hong Kong
853 - Macau
855 - Cambodia
856 - Laos
86 - China (PRC)
880 - Bangladesh
886 - Taiwan
90 - Turkey
91 - India
92 - Pakistan
93 - Afghanistan
94 - Sri Lanka
95 - Burma (Myanmar)
960 - Maldives
961 - Lebanon
962 - Jordan
963 - Syria
964 - Iraq
965 - Kuwait
966 - Saudi Arabia
967 - Yemen
968 - Oman
971 - United Arab Emirates
972 - Israel
973 - Bahrain
974 - Qatar
975 - Bhutan
976 - Mongolia
977 - Nepal
98 - Iran
993 - Turkmenistan
994 - Azerbaijan
995 - Georgia

Referring now to Figure 7, this figure illustrates an overview of the computer-implemented process for generating a rate plan and transferring it to a clearinghouse system **50**. Step **710** is the first step in the computer-implemented process of the internet telephony rate provisioning method and system **35**, where rates for a single network device are identified according to calling zones or exceptions to the calling zones or both. In an exemplary embodiment, the network devices can be gateways **108** or **114** that are part of the clearinghouse system **50**. However, the present invention is not limited to these types of network devices and can include other similar network devices. Other network devices include, but are not limited to, routers, gatekeepers, and other similar network devices.

Next, in step **715**, network device information and rate information are entered into pre-assigned cells of a rate table such as the rate table **600** as illustrated in Figure 6. Network device information can include a customer identification number, a device name (the Internet protocol address of a device), a service type (voice or fax), a type of plan (originating or terminating) the currency identification number, and a rate plan name. Basically, the rate information can correspond to cells **610A-610F**, as illustrated in Figure 6. A single rate table 600 is created for each device, each service type of the device, and each role of device. That is for a single device, several rate tables **600** may be needed. Exemplary scenarios that require separate rate tables **600** include, but are not limited to the following: a gateway that supports fax service in an originating role; a gateway that supports fax service in a terminating role; a gateway that supports voice service in an originating role; and a gateway that supports voice service in a terminating role. Thus, for each identified scenario, a separate rate table can be employed.

With the inventive system, the user could be provided with a template for an ordinary spreadsheet program such as Microsoft Excel for the purposes of entering the rate plan information. In an exemplary embodiment, the user would then save the Excel file as a CSV file prior to submitting it to the clearinghouse system **50**. Users, therefore, have the flexibility to bypass the spreadsheet program and create a CSV file directly. Rate Table **600** can be designed for any increments of time. In one exemplary embodiment, each rate table can denote a weekly schedule that includes a

single 24X7 time period. Add tionally, rates indicated in the rate table 600 can be in increments of rates per minute. However, other time increments are not beyond the scope of the present invention. Each rate table is associated with a single currency tool. In one exemplary environment, it is assumed there is only one clearinghouse account established for each user, and each clearinghouse account is associated with only one currency.

In one exemplary embodiment, an account can be established for each currency so that a user can select, within a single rate table, the currency associated with each rate listed in the table.

Each rate table 600 and its corresponding CSV file will be validated to ensure that the currency designated in the rate plan table 600 is equal to the currency associated with the user's clearinghouse account maintained in database **120** of the clearinghouse system **50**.

Next, in step **720**, the rate table 600 is stored in a file format that preserves the relative locations of the pre-assigned cells of the rate table 600. In one exemplary embodiment, the CSV file format is used to preserve the relative locations of the pre-assigned cells. However, as noted above, the present invention is not limited to the CSV file format. Other formats can be utilized as long as the relative locations of the pre-assigned cells can be reconstructed by the clearinghouse system **50** after it is transferred to the clearinghouse.

After step **720**, in routine **725**, the file containing the rate table is transferred to the centralized or clearinghouse system **50**. Further details of routine **725** will be discussed below with respect to Figures 8 and 10. In one exemplary embodiment, the rate table preserved in each file will typically include a complete set of rate plan data that is equivalent to an instance or version of a rate plan. That is, the rate table will typically include sufficient information to rate all traffic to all configured number prefixes from the date on which the file is sent to the clearinghouse system **50**. For each number string of the rate plan data, there typically must be at least one row with a "begin date" equal to or less than the current processing date. A file may include rates that become effective in the past and continue to be in effect. Therefore, a user

is not requested to restate "begin dates" each time a file is sent, and the file may represent a cumulative view of all previous versions of the file.

After routine **725**, in routine **730**, the rate plan data contained within a transferred file is received and validated. Further details of routine **730** will be discussed below with respect to Figures 9 and 11. All times relating to rate plan data as well as processing of the plan data by the clearinghouse system **50** is typically UTC-based. For example, upload or transferred date/time means upload or transferred date/time UTC. Also, the system time of the clearinghouse system is converted to system time UTC whenever the file is stored or used in a calculation. Rate plan effective dates and assignment effective dates displayed in the user interface are also UTC-based.

Also in step **730**, once the set of new rate plan data for the device is stored in the Billing Engine database, all previous rate plan data sets (previous assignment effective dates) for each combination of device name, role, and service type, will be flagged as "superseded", and these can be maintained in the Billing Engine database for a set period of time. Only the current version of the rate plan data is used to build views that are transmitted periodically to the database of the Service Points **112** where real-time routing decisions are made . When the Routing Engine **110** at the Service Point **112** makes a routing decision, it records the rate plan identification number in a call detail record. The call detail records are periodically transmitted from the Service Point **110** to the Billing Engine database. The rate plan identification number written to the call detail record is subsequently used by the Billing Engine to identify the rate to be used to rate the call for billing purposes.Next, in decision step **735**, it is determined whether a successful validation has occurred. If the inquiry to decision step **735** is negative, then the "no" match is followed back to step **710**. If the inquiry to decision step **735** is positive, then the "yes" match is followed to step **740**. In step **740**, the rate information from the rate table is stored in the Billing Engine database from which it is transmitted to the Service Point(s) **112** after a predefined period of time. Typically, the clearinghouse system **50** will disseminate rate plan data to service point **125** within 48 hours of receipt of the rate plan file. The new rate plan

data set will have an assignment effective date equal to the date/time when the date is written to the Billing Engine database **122** plus 24 hours.

Thereafter, it will be possible for users to view rate plan data (retrieved from the Billing Engine database) through a user interface supported by web site **122**. Users will be able to view the most current set of rate plan data only for their devices. The user interface selects from the Billing Engine database and displays rate plan data with the most current upload date/time.

After step **740**, in decision step **745**, it is determined whether a request to view rate information has been received. If the inquiry to decision step **745** is negative, then the "no" branch is followed. If the inquiry to decision step **745** is positive, then the "yes" branch is followed to step **750**, in which the rate plan information is displayed on website **122** through a user interface.

Referring now to Figure 8, this figure illustrates a computer-implemented process for the transfer file routine **725** of Figure 7. Step **810A** is the first step in routine **725A**, in which an e-mail message as set forth in Figure 4 is created. Next, in step **815A**, portions of the device information is identified in a predefined format in the subject line **430** of the e-mail message **410**. In step **820A**, the file created in step **720** is attached to the e-mail message **410**. Next, in step **825A**, the e-mail message **410** is sent to the centralized or clearinghouse system **50**. In step **830A**, the process returns to routine **730** of Figure 7. The present invention is not limited to the aforementioned transfer methods. Other transfer methods include, but are not limited to, fax, forwarding files on disk, and other like methods.

Referring now to Figure 9, this figure illustrates a computer-implemented process for the receive and validate data routine **730** of Figure 7. Step **910A** is the first step in routine **730A**, in which receipt of the file transferred in step **725** to the centralized or clearinghouse system **50** is logged. In step **915A**, the CSV file is stored in a rate plan database **120**. Next, in step **920A**, the status of the file is logged. In this step, once it becomes possible for a user to upload the rate plan file via an upload link on the user interface, a real-time review is performed and the user can be advised immediately if the rate plan file is accepted for further processing. In step **925A**, data contained within the CSV file is validated. The validation process can include, but is

not limited to, comparing data within the reconstructed rate plan table with a cell assignment template, in comparing device information against device information contained within the database **120**. Other exemplary validation functions include, but are not limited to the following: (Examples of preliminary validation, before storing the file in the website exemplary embodiment of Figures 10 and 11, include items 1 through 6 below. Secondary validation that can take place during processing following uploading include items 7 and 8 below. For the E-mail exemplary embodiment of Figures 9 and 10, both preliminary and secondary validation will take place at the time the file is processed following receipt of the file via e-mail.)

1. Validate field values according to Tables III and Table IV.

2. Validate that there are no duplicate rows for the combination of Zone, CC, City/NPA-NXX and Begin Date.

3. Validate that there is at least one row with "Zone" = "OT"

4. Validate that for each combination of Zone, CC, and City/NPA-NXX there is at least one row with a "Begin Date" equal to or less than the current processing date (sysdate).

5. Validates that required fields are populated.

If "Allow" = "Y" and "Role" = "O", there must be a valid value in each field except "Maximum Delay (ms)".

If "Allow" = "Y" and "Role" = "T", there must be a valid value in each field except "Maximum Delay (ms)" and "Routing Priority".

If "Allow" = "N" and "Role" = "O" or "T", there must be a valid value in each field except "Rate", "Unit of Measure", "Increment", "Maximum Delay (ms)" and "Routing Priority".

6. Validate that the first row of rates is preceded by a row with "BEGIN" in the "Zone" field, and the last row of rates is followed by a row with "END" in the "Zone" field.

7. Validate the combination of "Customer ID" and "Device Name".

8. Validate combination of "Customer ID" and "Device Name" with "Role".

9. If there is a value in Column A of the rate plan table, there cannot be values in Columns B and C and vice versa.

10. Validate "Currency" with customer's clearing account currency or user's currency in a user table

The present invention is not limited to the aforementioned validation functions or techniques. The present invention could include any number of validation functions or techniques or both. In step **930A**, the result of the validation step **925A** is logged. In other words, if the file is accepted, the user interface can display the status of the file from receipt through secondary validation and storage of rate plan data in the Billing Engine database, at which point this data is viewable by the user via the user interface. In step **935A**, the process returns to step **35** of Figure 7.

Referring now to Figure 10, this figure illustrates another computer-implemented process for the transfer of file routine **725** of Figure 7. Step **1010** is the first step of routine **725B**, in which the user interface of the centralized or clearinghouse system **50** is displayed on website **122**. In step **1015**, an upload link such as link **540**, as illustrated in Figure 5, is activated. Next, in step **1020**, the location of the CSV file created in step **720** is identified. In step **1025**, the uploading process for the CSV file is initiated. In step **1030**, the process returns to routine **730** of Figure 7.

Referring now to Figure 11, this figure also illustrates another computer-implemented process for the receive and validate routine **730** of Figure 7. Step **1110** is the first step of routine **730B** in which a first validation process is initiated while the file data is being received during the transfer process. This first validation process can be referred to as a preliminary validation before the rate plan data is written or stored in the database **120**. Next, in step **1115**, the CSV file transferred in step **725** is stored in the rate plan database **120**. In step **1120**, a second validation process is initiated. In decision step **1125**, it is determined whether a successful validation process has occurred. If the inquiry to decision step **1125** is negative, then the "No" branch is followed to step **1140**. If the inquiry to decision step **1125** is positive, then the "Yes" branch is followed to step **1130** in which the file data is forwarded to tables in the Billing Engine database from which the web site **122** retrieves rate plan data as illustrated in Figure 2.

In step **1135**, a message is sent to the user acknowledging the successful validation of the reconstructed rate plan table. After step **1135**, the process proceeds to step **1145** in which the tracking information pertaining to the upload is logged. That is, parameters such as the upload time is recorded in UTC based time. In step **1140**, a message is sent to the user and to the centralized for clearinghouse system **50** indicating that unsuccessful validation has occurred. This message can also include error details that identify any specific problems with the CSV file that was transferred. In step **1150**, the process returns to decision step **735** of Figure 7.

It should be understood that the foregoing relates only to illustrative embodiments of the present invention, and numerous changes may be made therein without departing from the spirit and scope of the invention as defined by the following claims.

What is claimed is:

1. A method for creating and implementing a rate plan for a network device within an Internet telephony clearinghouse system, comprising the steps of:

identifying calling rates for a single network device;

placing network device information and the calling rates into preassigned cells of a rate table;

storing the table in a file format that preserves relative locations of the preassigned cells in the rate table; and

transferring the file to a the Internet telephony clearinghouse system.

2. The method of claim 1, wherein the step of identifying calling rates further comprises identifying calling rates according to at least one of predefined calling zones and country-city code combinations

3. The method of claim 2, wherein the step of identifying calling rates further comprises identifying calling rates according exceptions to the calling zones.

4. The method of claim 1, wherein network device information comprises at least one of a customer identification number, an Internet Protocol address for the network device, a type of service supported by the network device, a type of traffic supported by the network device, and a rate plan name.

5. The method of claim 1, wherein the file format comprises a comma separated values (CSV) format.

6. The method of claim 1, wherein the step of transferring the file, further comprises transferring the file via an E-mail message.

7. The method of claim 1, wherein the step of transferring the file, further comprises transferring the file via a file transfer protocol and real-time validation supported by a website.

8. A method for creating and implementing a rate plan for a network device within an Internet telephony clearinghouse system, comprising the steps of:

receiving a file in a predefined format that contains relative locations of preassigned cells in a rate table;

validating the rate plan data; storing the rate plan data in a database; and

periodically transmitting selected rate plan data to a service point network devices where routing decisions are made.

9. The method of claim 8, wherein the file format comprises a comma separated values (CSV) format.

10. The method of claim 8, wherein the step of receiving the file, further comprises receiving the file via an E-mail message.

11. The method of claim 8, wherein the step of transferring the file, further comprises receiving the file via a file transfer protocol supported by a website.

12. The method of claim 8, wherein the step of validating the rate plan data further comprises comparing the rate plan data to a rate table template listing acceptable ranges of values for particular cells.

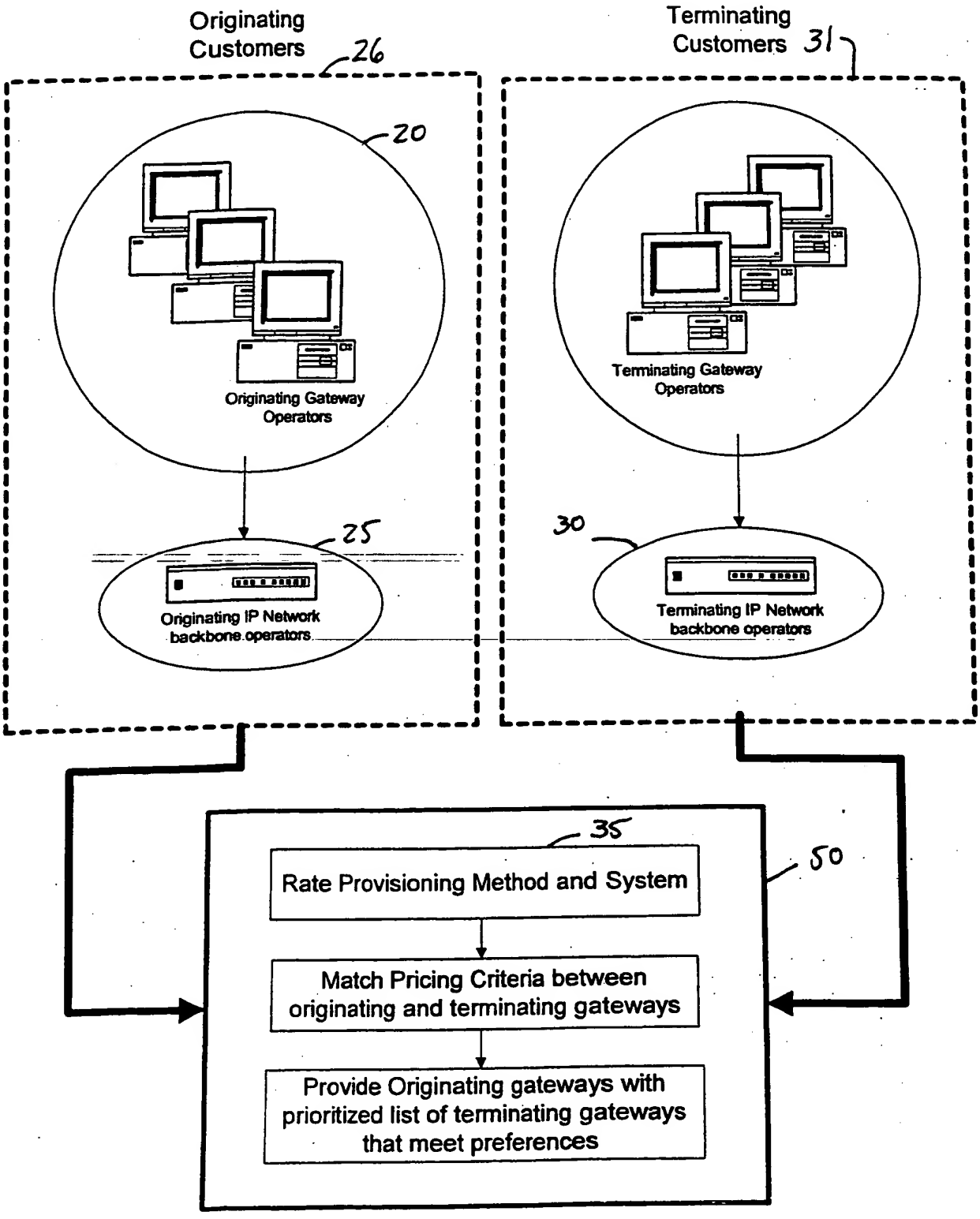
Originating Customers
26
Terminating Customers
31
20
Originating Gateway Operators
Terminating Gateway Operators
25
30
Originating IP Network backbone operators
Terminating IP Network backbone operators
35
50
Rate Provisioning Method and System
Match Pricing Criteria between originating and terminating gateways
Provide Originating gateways with prioritized list of terminating gateways that meet preferences

FIG. 1

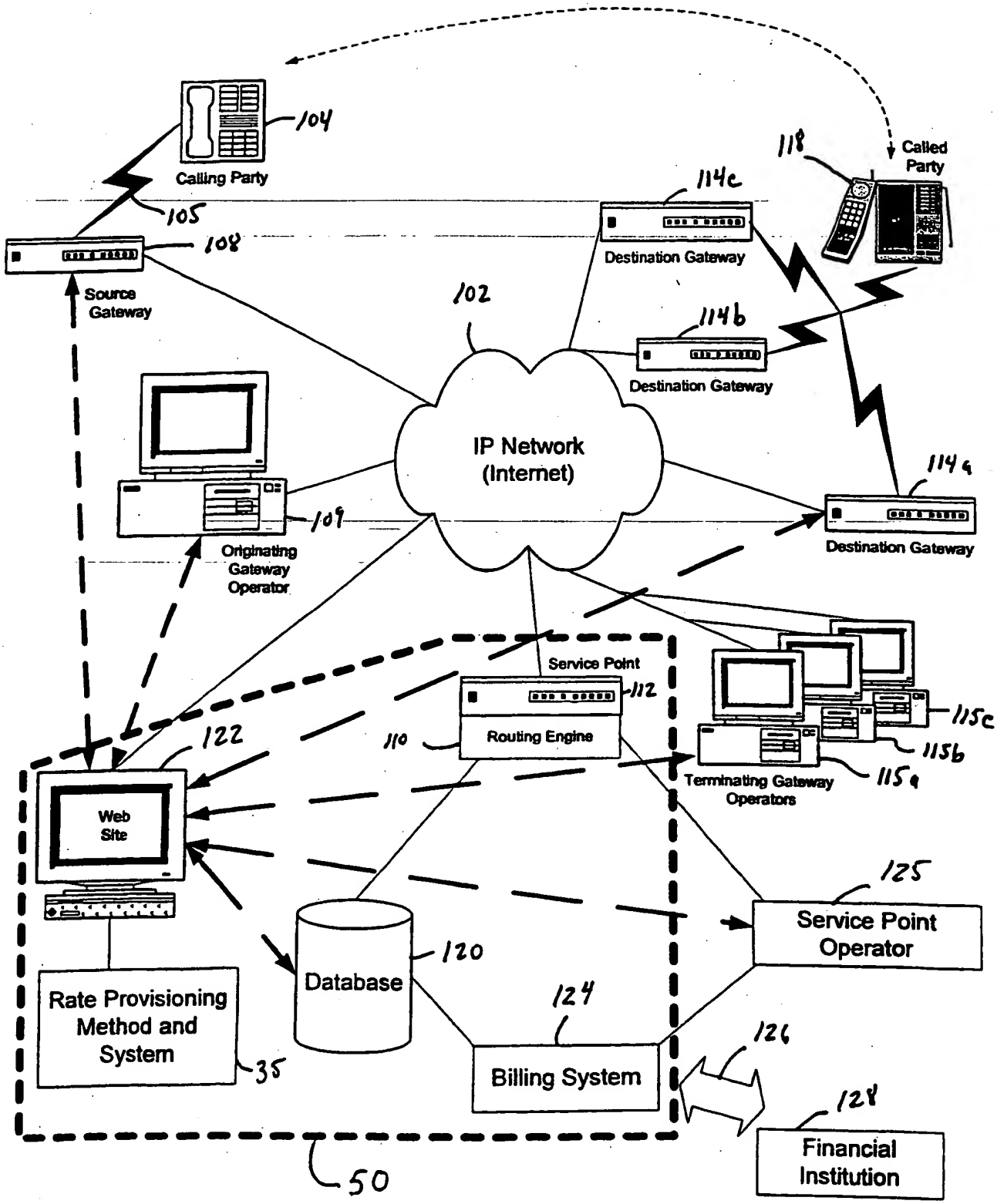
104
Calling Party
105
108
Source Gateway
102
IP Network (Internet)
118
Called Party
114c
Destination Gateway
114b
Destination Gateway
114a
Destination Gateway
109
Originating Gateway Operator
Service Point
112
Routing Engine
110
122
Web Site
115c
115b
115a
Terminating Gateway Operators
125
Service Point Operator
120
Database
Rate Provisioning Method and System
35
124
Billing System
126
128
Financial Institution
50

FIG. 2

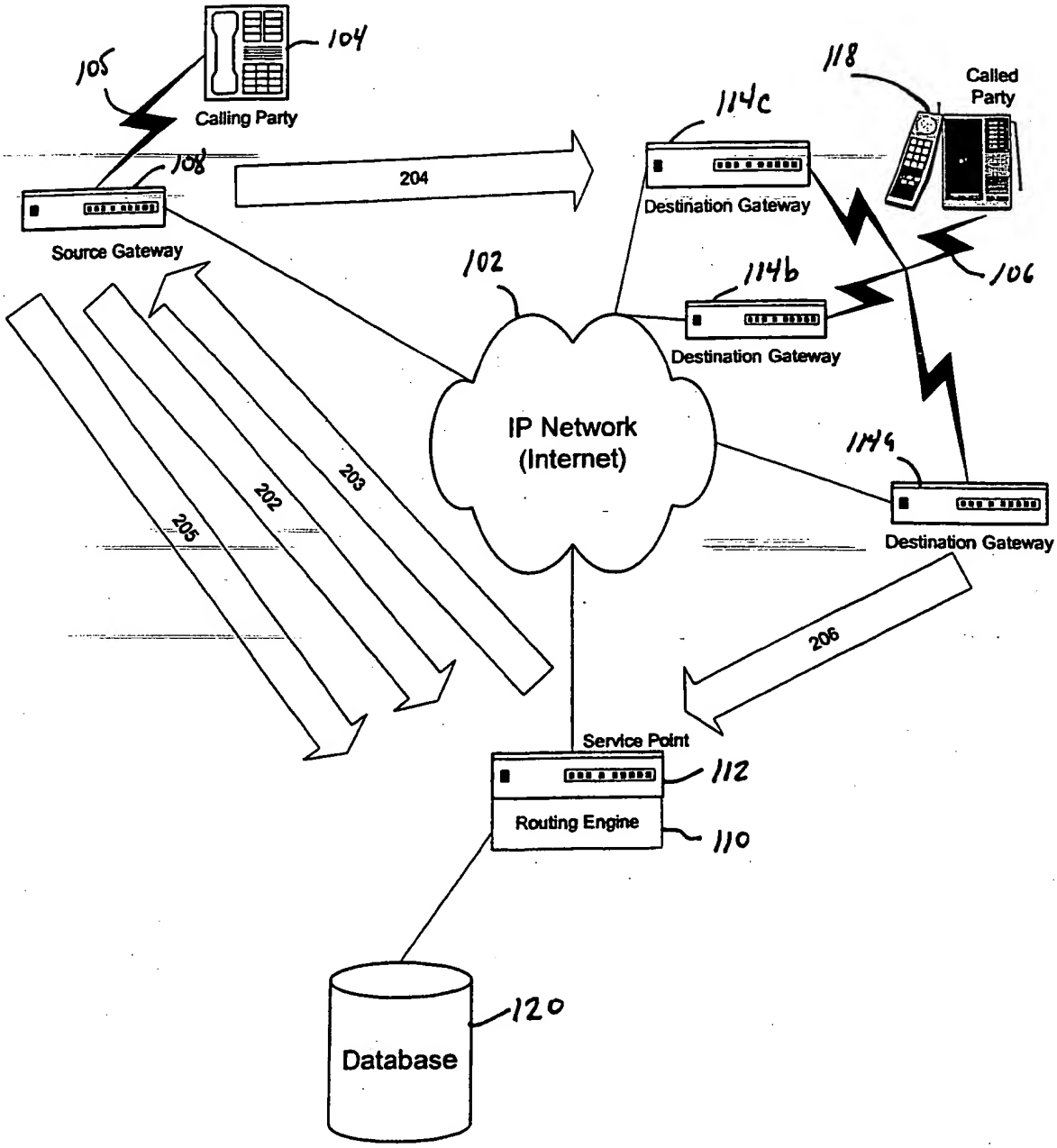
104
105
Calling Party
108
Source Gateway
204
114c
Destination Gateway
118
Called Party
106
102
114b
Destination Gateway
IP Network
(Internet)
114a
Destination Gateway
205
202
203
206
Service Point
112
Routing Engine
110
120
Database

FIG. 3

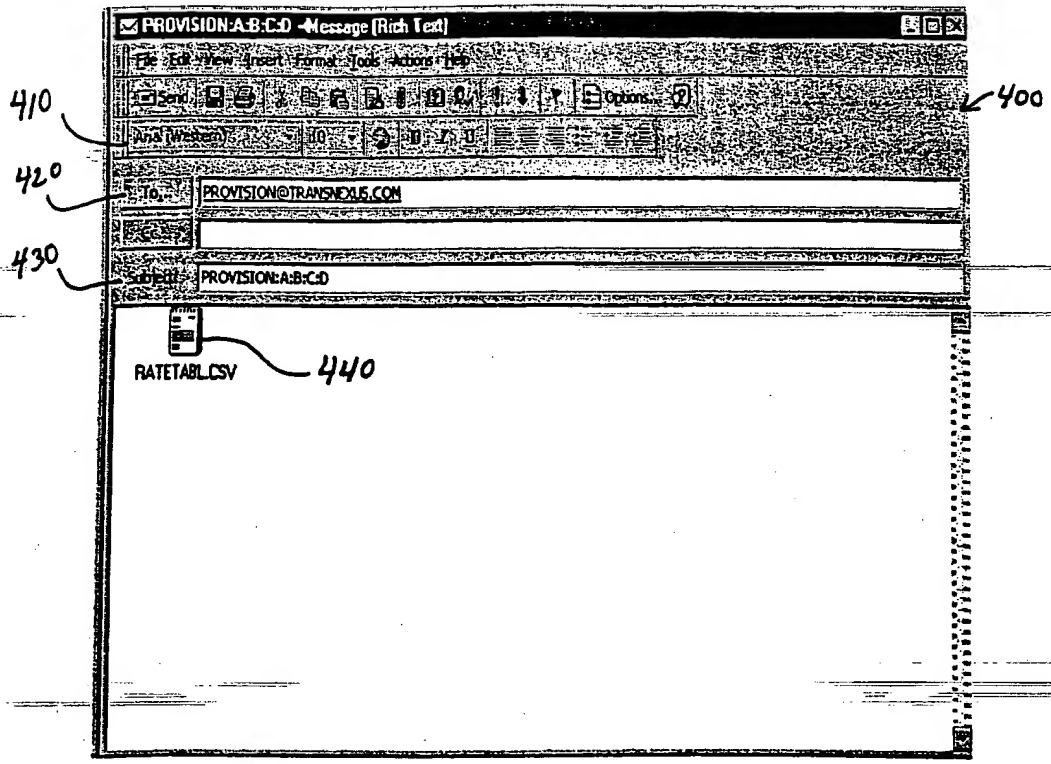
PROVISION:A:B:C:D - Message (Rich Text)
File Edit View Insert Format Tools Actions Help
Send
Options...
Arial (Western)
To...
PROVISION@TRANSNEXUS.COM
Cc...
Subject:
PROVISION:A:B:C:D
RATETABL.CSV
410
420
430
440
400

FIG. 4

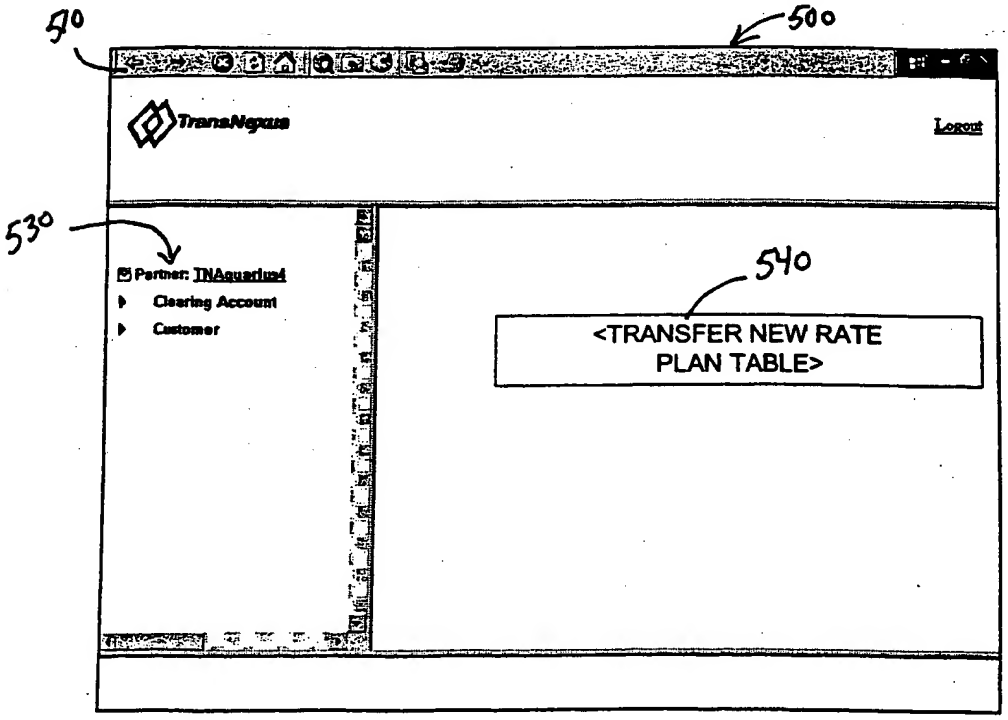
TransNexus
Logout
Partner: TNAquarius4
Clearing Account
Customer
<TRANSFER NEW RATE PLAN TABLE>
510
500
530
540

FIG. 5

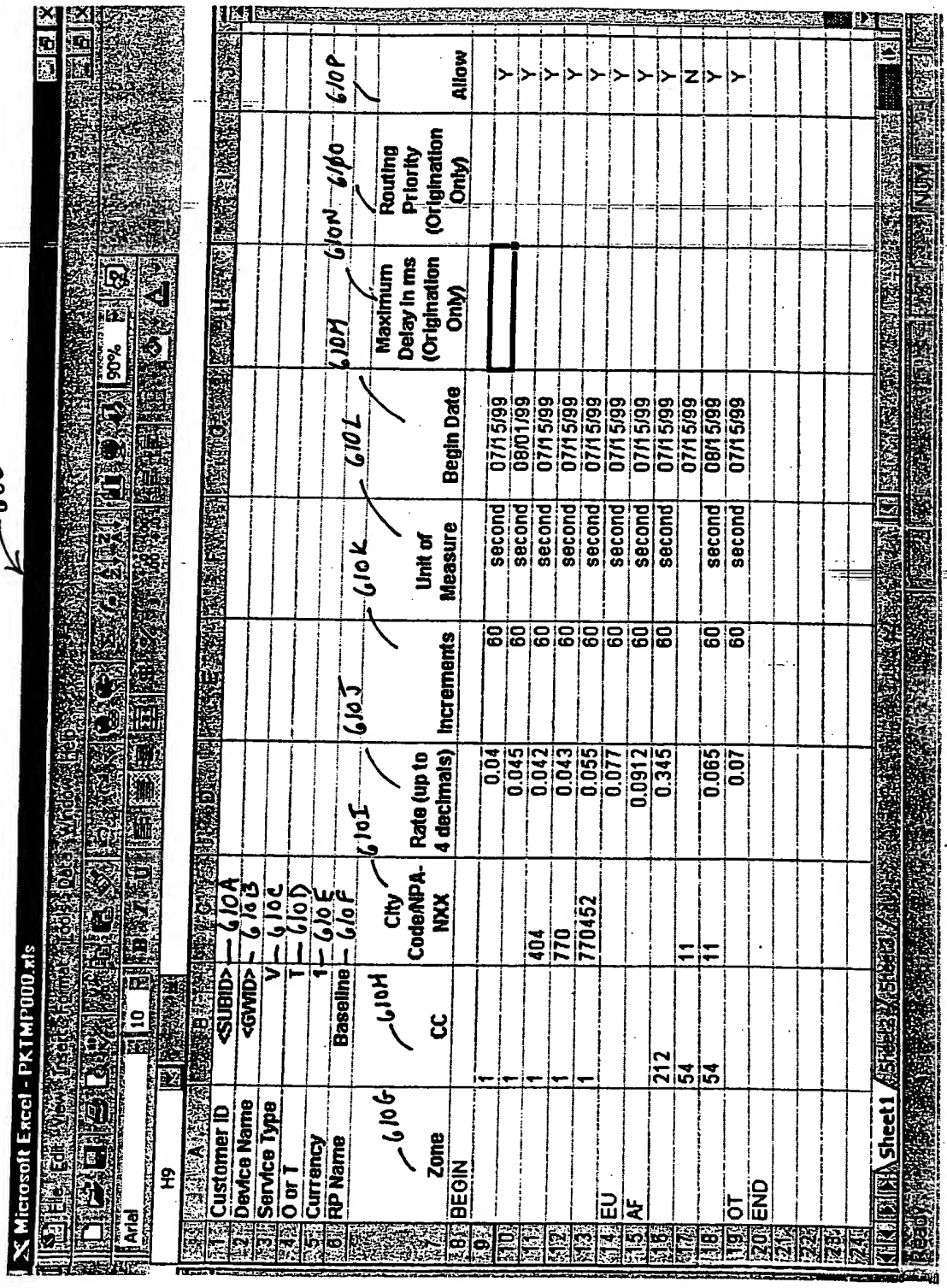
600
Microsoft Excel - PKTMP000.xls
Customer ID <SUBID> 610A
Device Name <GWID> 610B
Service Type V 610C
O or T T 610D
Currency 1 610E
RP Name Baseline 610F
610G
610H
610I
610J
610K
610L
610M
610N
610O
610P
Zone
CC
City Code/NPA-NXX
Rate (up to 4 decimals)
Increments
Unit of Measure
Begin Date
Maximum Delay in ms (Origination Only)
Routing Priority (Origination Only)
Allow
BEGIN
EU
AF
OT
END
Sheet1

FIG. 6

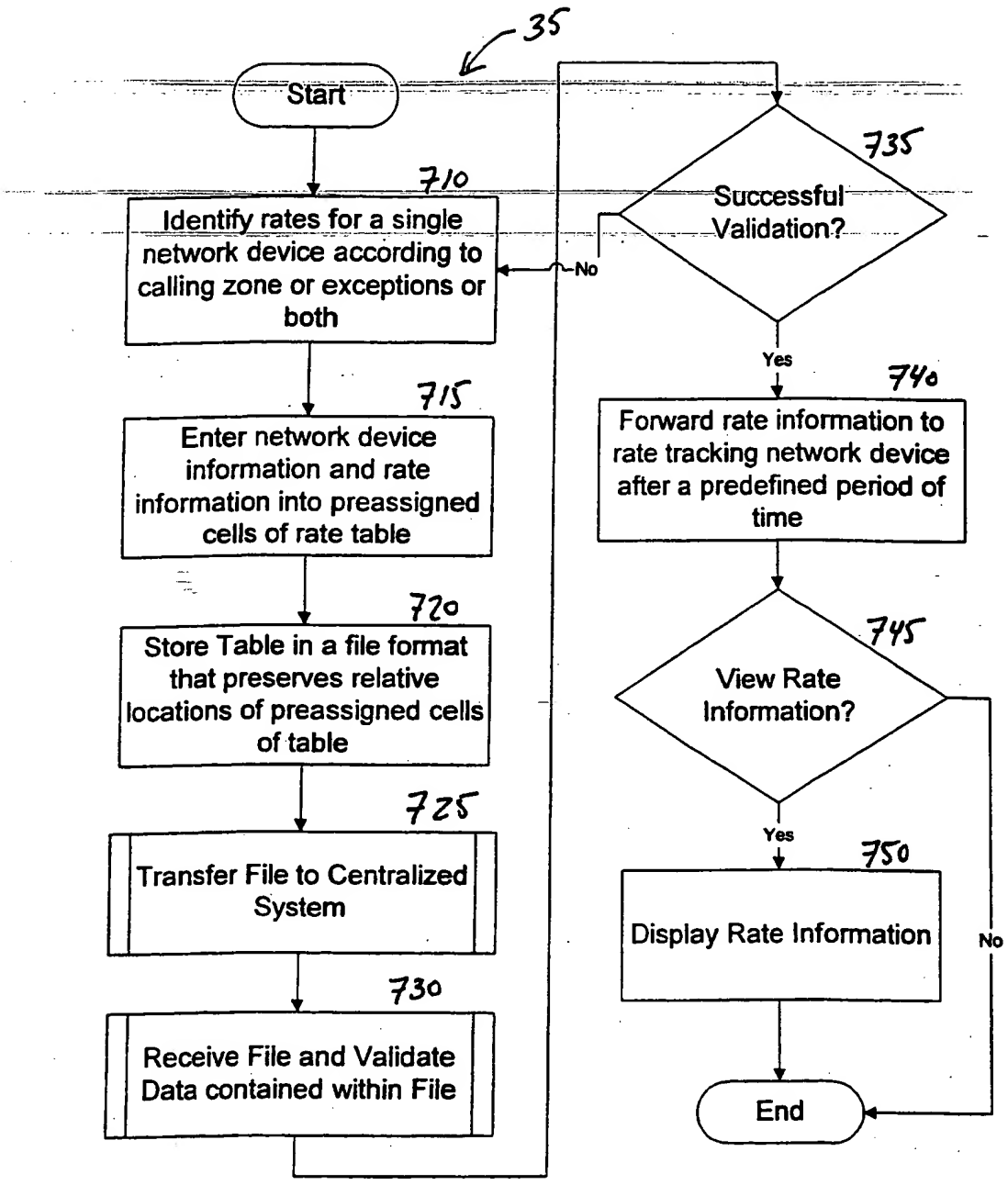
35
Start
710
Identify rates for a single network device according to calling zone or exceptions or both
715
Enter network device information and rate information into preassigned cells of rate table
720
Store Table in a file format that preserves relative locations of preassigned cells of table
725
Transfer File to Centralized System
730
Receive File and Validate Data contained within File
735
Successful Validation?
No
Yes
740
Forward rate information to rate tracking network device after a predefined period of time
745
View Rate Information?
Yes
No
750
Display Rate Information
End

FIG. 7

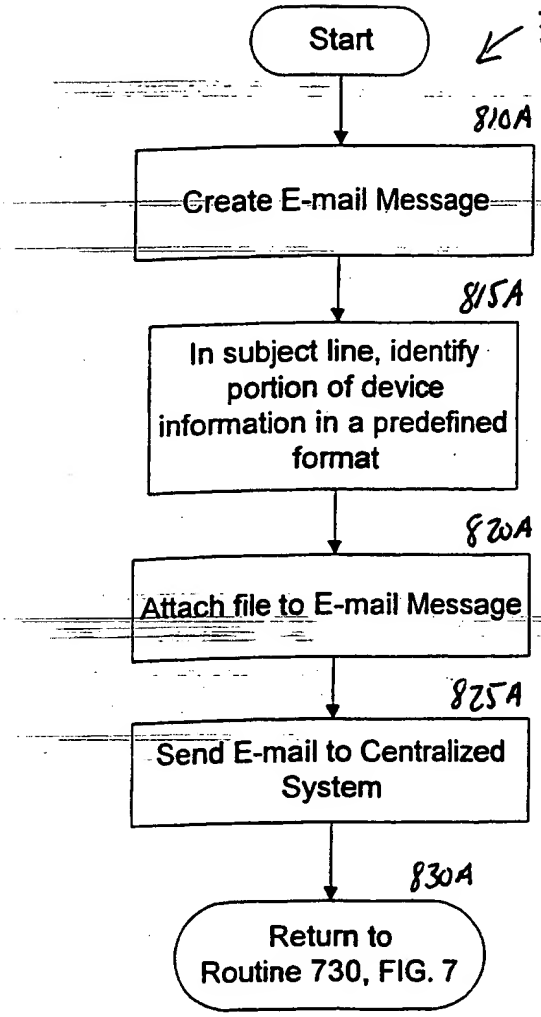
Start
725A
810A
Create E-mail Message
815A
In subject line, identify portion of device information in a predefined format
820A
Attach file to E-mail Message
825A
Send E-mail to Centralized System
830A
Return to Routine 730, FIG. 7

FIG. 8

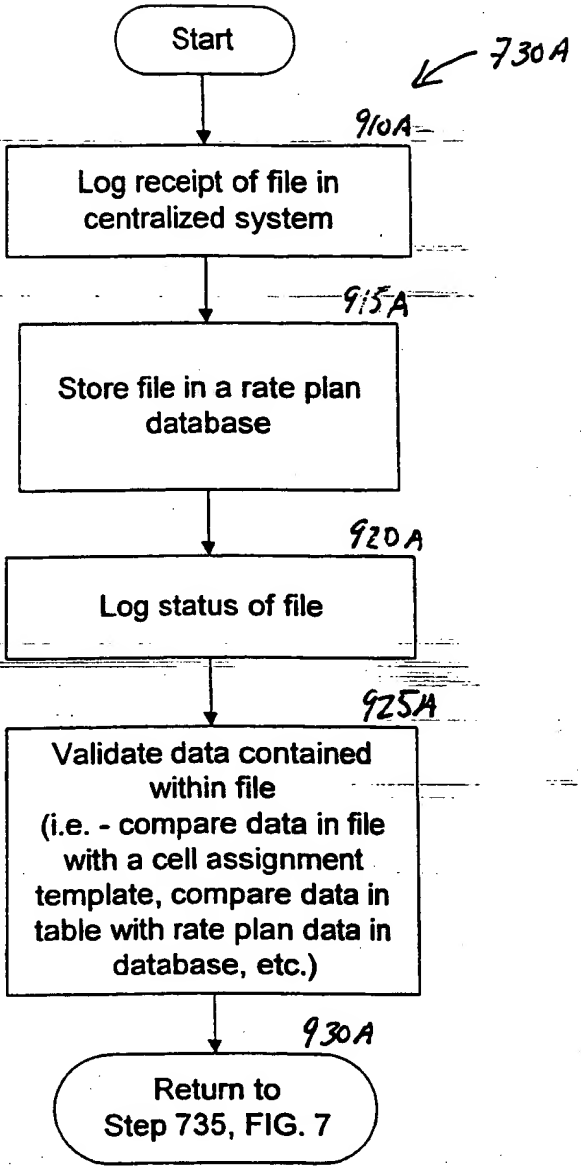
Start
730A
910A
Log receipt of file in centralized system
915A
Store file in a rate plan database
920A
Log status of file
925A
Validate data contained within file (i.e. - compare data in file with a cell assignment template, compare data in table with rate plan data in database, etc.)
930A
Return to Step 735, FIG. 7

FIG. 9

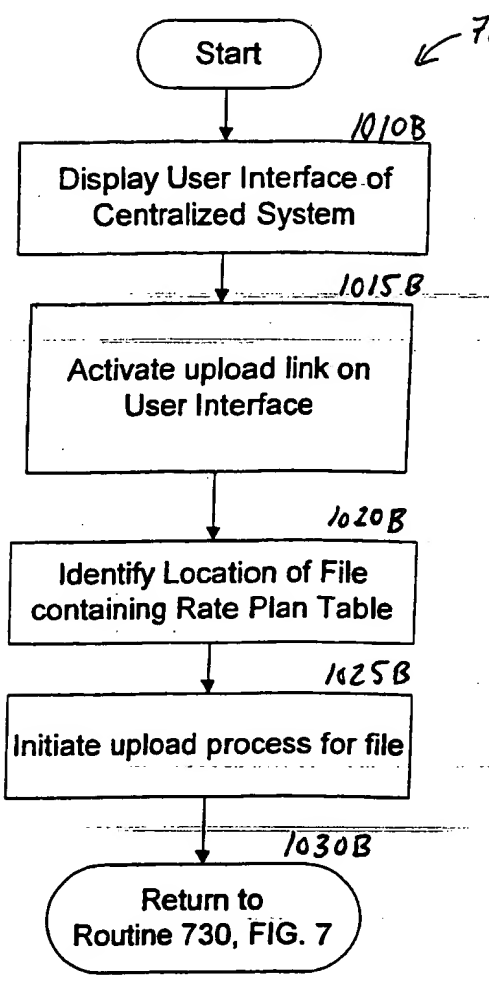
725B
Start
1010B
Display User Interface of Centralized System
1015B
Activate upload link on User Interface
1020B
Identify Location of File containing Rate Plan Table
1025B
Initiate upload process for file
1030B
Return to Routine 730, FIG. 7

FIG. 10

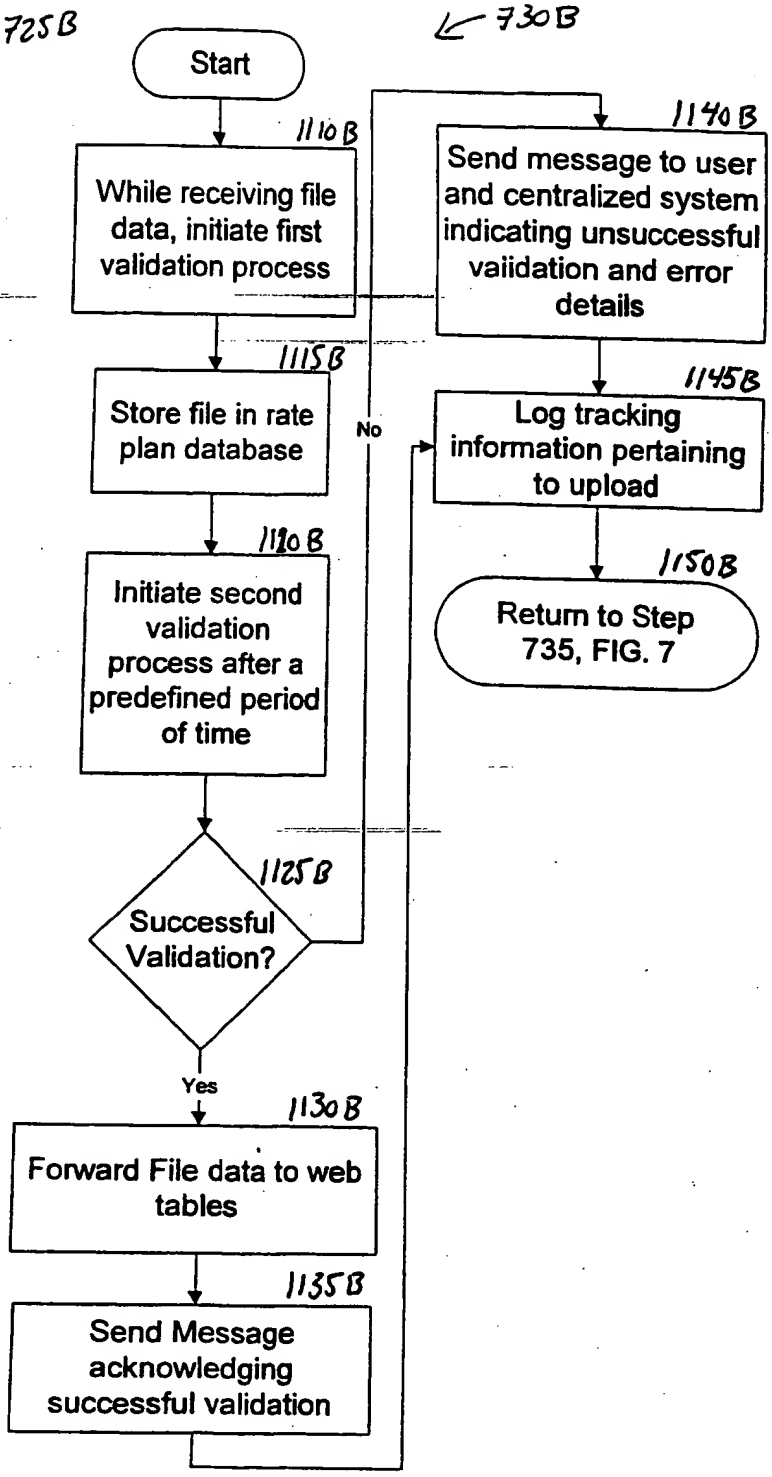
730B
Start
1110B
While receiving file data, initiate first validation process
1115B
Store file in rate plan database
1120B
Initiate second validation process after a predefined period of time
1125B
Successful Validation?
No
Yes
1130B
Forward File data to web tables
1135B
Send Message acknowledging successful validation
1140B
Send message to user and centralized system indicating unsuccessful validation and error details
1145B
Log tracking information pertaining to upload
1150B
Return to Step 735, FIG. 7

FIG. 11